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| **Project Title: Caring for Terry the Trout** | |
| **Directions:** Please read the following scenario and back-story of Terry the Trout, a brook trout that has been orphaned. You meet up with him one day as you are walking along Cedar Beach Park in Allentown. Your goal as a high school biology student is to help educate Terry the Trout so he can learn to survive on his own and thrive to become a mature, fully grown trout. You will do this by completing several tasks that deal with the different areas of biology covered in the first semester. | |
| http://mywestend.files.wordpress.com/2011/07/paddleboatmap.jpg**Scenario:** Terry the Trout is a brook trout native to Pennsylvania. Like most brook trout, he has some developmental issues that may keep him undersized or incapable of doing certain things. Because of his developmental issues, Terry the Trout is depending on you, the biology student for help. Terry the Trout needs to be taught certain life skills including how to hide from predators, what to eat, how to react to situations, and what conditions and environment he will be able to survive under. You meet Terry the Trout as you were walking home through Cedar Beach Park in Allentown after shooting hoops and chillin' at the basketball court. We know that Terry the Trout's home is Lake Muhlenberg which surrounds the park and runs along Hamilton Blvd and Ott Street in Allentown, and the Lake will run into tributary creeks to and from the Little Lehigh Creek off of South 12th Street in Allentown. Terry the Trout is depending on you as a biology student to educate him to ensure his survival. Unfortunately, you will have to work quickly because of two environmental factors. The first environmental factor is the Department of Parks and Recreation dumped in a chemical (copper sulfate) to cut down on and kill the population of invasive weeds and leftover mosquito larvae from the summer. This chemical was placed into the portion of the lake that does not empty into the Little Lehigh, but flows to a creek leading behind Dorney Park to the river (marked on map with 4-pointed star). However, the copper sulfate may change the pH of the water, which could lead to enzymatic and cellular problems, affecting Terry the Trout's health. The second environmental factor is temperature. The temperature is starting to dip down into the 20's and the lake may start to freeze solid on top for the winter. | |
| **TASK and CONCEPT** | **TASKS TO BE COMPLETED BY EITHER ANSWERING QUESTIONS OR EXECUTING A STRATEGY WITHIN A CONCEPT** |
| Task #1: Characteristics of Living Things | **A. Terry the Trout does not know the difference from a rock versus a predator such as a snapping turtle that is staying still to catch prey. Your task is to list and describe at least 5 characteristics of living things that prove something is alive.** |
| Task #2: Theories of Biology | **A. One theory that drives the force of Biology is Evolution. Since Terry the Trout has some developmental problems; Terry the Trout needs to know if and how evolution can help him and his future offspring thrive and survive.**  1. Discuss what evolution is and give an example by how it could apply to Terry the Trout and his offspring.  2. Define what an adaptation is. Construct a logical argument that will let Terry the Trout understand that he will be able to adapt to certain situations that he could face.  3. Explain how natural selection could help the native brook trout species become stronger (think of the species’ genes).  **B. Another theory that is a driving force of Biology is Germ Theory. Fish such as Terry the Trout can contract parasites, fungal infections, and bacterial infections. Terry the Trout thinks that this is not that big of a deal to worry about.**  1. Debate with Terry the Trout that this is an important theory because it can lead to serious illness and possible death.  2. Because Terry the Trout is a fish and cannot jump out of the water and go to a doctor, what could he do if he should encounter such infections? |
| Task #3: Reaction Times and Reflexes | **A. Compare and contrast what you know and what you have experienced with reflexes versus a reaction time.**  **B. Hypothesize and discuss how reaction time will affect Terry the Trout's survival.**  **C. Hypothesize and discuss how good versus bad reflexes will affect Terry the Trout's survival rate?**  **D. Discuss what factors, both good and bad, that can affect the reaction time for an organism.** |
| Task #4: Properties of Water: The Lake | **A. In the scenario, second environmental factor mentioned is the freezing cold weather is falling upon the lake, which will freeze part of it over as referenced by the diagram to the right.**  1. What property of water is exhibited by the lake freezing, and what is happening to the lake?  2. In which depth of the lake (top, bottom, or middle) should Terry the Trout go to and reside for the winter? Why, explain what happens to the temperature of the water at that depth?  B. In the scenario, it was stated that the chemical dumped into the lake is copper sulfate. Copper sulfate when mixed with water acts as a surfactant. That is going to cause a drastic change for all aquatic animals. How will Terry the Trout be affected by this?  1. Describe what surface tension is and how it supports living organisms. Give an example.  2. Discuss what the surfactant will do to the water and how it will affect the water life and Terry the Trout? |
| Task #5: Properties of Water: Acids/Bases | **ph scaleA. The pH Scale is located to the right. Terry the Trout, who is a brook trout needs a 6.7 pH. The copper sulfate that was dumped in the lake (where the 4-point star is located) is a basic chemical with a pH of 10.**  1. Knowing this information about the chemical's pH and location of the lake, you need to devise a plan for Terry the Trout's survival. Where would you tell him to go in the lake to live for awhile until the copper sulfate dicipates out of the lake?  2. Draw a conclusion as to what needs to happen to the pH level of the lake in order for the pH level to return to 6.7 pH needed for Terry the Trout? |
| Task #6: Organic Chemistry: Terry the Trout's Diet | **A. Terry the Trout has no idea how to eat so he has a diet that will sustain him through a day and also become a big strong adult trout. Using your knowledge on organic chemistry, help Terry the Trout with his diet.**  1. Explain the purpose and role of carbohydrates and why they are essential for a diet for a living organism.  2. Explain the purpose and role of lipids and why they are essential for a diet for a living organism.  3. Explain the purpose and role of proteins and why they are essential for a diet for a living organism.  **B. Create a diet of what Terry the Trout should eat, what the foods contain, and why (in other words what will the food do for Terry the Trout’s health and survival)?** |
| Task #7: Enzymes: Lake Chemistry and Survival | A. Discuss the purpose of enzymes in biological systems.  B. Construct a logical argument about how pH alters enzymes and their functions based on the lock and key model.  C. Looking at the graph below, answer the questions about Terry the Trout's survival. The graph shows Terry the Trout’s enzyme activity for survival.  http://dtc.pima.edu/blc/181/Lessons/L5/5step7/5step7images/2enzymephgraph.gif  1. What is the optimal pH for enzyme #1?  2. What is the optimal pH for enzyme #2?  3. Analyze if Terry the Trout would be able to survive the copper sulfate portion of the lake and why. |
| Task #8: Cell Structure and Function: Survival | You and Terry the Trout discuss that all living things are made of cells, and that both you and him have eukaryotic animal cells that have individual organelles. These organelles make the cell function as a whole for his survival.   1. **Your task is to sketch a general animal cell with at least 5 organelles (labeled) and then give a brief job description of these organelles and why they need to stay functional.** |
| Task #9: Cell Membrane and Transport | **A. Draw a rough sketch of the cellular membrane and demonstrate what passive transport would look like for a carbohydrate getting into the cell. Also, demonstrate what active transport would look like for a protein that needs to get out of the cell to aide in cell repair.** |
| Task #10: Cell Membrane and Tonicity (water regulation) | Terry the Trout knows that he needs to make sure that his water is regulated in all of his cells for survival (no dehydration and no over hydration). He wants to know how to do this because it is important to keep a balance of salt and sugar for survival.   1. **Define the term homeostasis and its importance for salt, sugar, and water balance in a living organism.** 2. **Sketch a blood cell that has gone through the extreme levels of tonicity. With your sketches, show the direction of water flow and how the cell would react including how the organism would feel.** |
| Task #11: Cell Size: Surface Area and Volume | If Terry the Trout cannot regulate his water or if he takes in a specific chemical that causes his cells to shrink or expand, this causes a huge effect on his cellular size which can curtail his cells’ functions.  Let’s say hypothetically, Terry the Trout decides to reside in the portion of the lake with the copper sulfate. The chemical distorts and distends his cells horribly. Do the calculations for a normal cell and his cells and hypothesize what could happen to Terry the Trout along the way.   |  |  |  | | --- | --- | --- | | Normal Cell Dimensions: 2cm x2 cm x 2cm | Cell Surface Area | Cell Volume | | Terry’s Contaminated Cell Dimensions:  2cm x 6cm x4 cm | Cell Surface Area | Cell Volume |   Hypothesis and Analysis: Compare the normal cell dimensions to the contaminated cell dimensions. What could possibly happen to Terry the Trout’s body cells and what could happen to his health overall? |
| Task #12 : Reflection | What is the overall impact on living organisms when chemicals are placed into a lake? Please give 4-5 lines. (COLLINS 1) |